COTTON MANUFACTURE

Synopsis of Film

1. The Old Method: Hand Carding.
2. The Product of a Day's Work.
3. The Spinning Wheel.
4. Weaving with the Hand Loom.
5. The Modern Method: Breaking the Bales at the "Openers."
6. From the Openers to the Dye House.
7. Ready for Bleaching or Dyeing.
8. The Vacuum Bleaching and Dyeing Machines.
9. Removing Moisture in Centrifugal Extractors.
10. Entering the Steam Dryer.
11. In Picker Room. Removing Foreign Matter and Seeds left by Gin.
12. The Lint Coming from Picker in a Roll or "Lap."
13. Laps Arriving at Card Room.
14. The Card Room.
15. Gathering the Carded Cotton into a "Sliver."
16. The Drawing Frames Extending and Reducing the Sliver.

17. The Slubber. Winding Sliver on Bobbins.
18. Removing Full Bobbins; Called "Doffing."
19. The Roving Frame Uniting Several Slivers and Reducing their Size.
20. Spinning the Yarn.
21. Steaming Yarn to Prevent Kinking.
22. Winding Yarn onto Spools, each Holding 2,400 Yards.
23. Winding Yarn from Several Hundred Spools on a "Beam."
24. Dressing. Sizing the Yarn.
25. Drawing in the Web by Hand.
26. Warp Tying Machine which has Displaced Hand Drawing.
27. Looms in Operation. Note Movement of Harnesses and Lay.
28. A Gingham Loom. Each Shuttle Box (at left) Holds a Different Color Yarn.
29. Operating Loom Slowly to Show How "Filling" is Deposited.
30. Stretching Goods to Finished Width.
31. Calendering. (Pressing Cloth with Heated Rolls.)
32. Folding and Inspecting.

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THE manufacture of cotton goods ranks as one of the World's leading industries. The peculiar adaptability of the cotton fibre for spinning, its cheapness, and the ease with which the plant can be grown, all have contributed to the present annual production of over 25 million 500-lb. bales, which is an increase of more than 700 per cent. over the amount produced in the middle of the last century. In the United States alone, some 35 million spindles are turning in cotton mills and the value of manufactured products approaches the billion dollar mark. The industry furnishes a livelihood for about 400,000 people, whose wages total approximately $150,000,000 a year.

The preparation of the cotton for use in weaving calls for a sorting and straightening of the lint, a gathering of the fibres into a "sliver," and a twisting or spinning of the sliver into a thread.

When cotton is picked by hand or machine, it is taken to the gin, where the seed is removed. The lint, separated from much dirt, twigs and leaves, is compressed into bales which in the United States average about 500 pounds. These bales are roughly covered with a coarse burlap and bound with straps of iron for transportation.

At the mill the matted and tangled mass from the bale is thrown into a "breaker" (5)* which shakes out the fibres and delivers a layer, or "lap" of cotton (12), much resembling the common cotton wadding which, in a "finished lapper," is combined with other laps into a smoother and more even layer. From this machine the lap goes to the carding machine (14), the main feature of which is a large drum covered with card-clothing, having small steel wire teeth—as many as 600 to the square inch. An endless belt with other similar teeth moves more slowly above the drum with only sufficient clearance to prevent contact. In pass-

* Numbers in parentheses ( ) refer to titles in synopsis.

ing between these two sets of teeth, the fibres become straightened and the shorter, unsuitable lengths are eliminated. When the carded cotton leaves the machine in the form of a thin, fleecy film, it passes through a trumpet and between two rolls to form a "card sliver" about an inch thick (15).

From four to eight of these slivers are combined in the drawing frame (16), in which they are drawn out to six times their original length and the fibres are made more nearly parallel. The result is the drawing sliver which is of practically the same size as the card sliver. The uniform drawing sliver now passes to the first roving frame or "slubber" (17), there receiving more extension and the first twisting. The twisted "roving" as it is now called, is wound on bobbins and sent to a second roving frame for more "thinning" and twisting, and lastly goes into the spinning ring frame (20) or to the spinning "mules." The finished yarn is now a comparatively firm thread some 32 times as long as the original lap, having between 20 and 30 twists to the inch. For sewing thread several of these yarn threads are twisted together and drawn out to the proper size.

Dyeing may be done either before or after weaving. In the vacuum bleaching and dyeing machine (8), 1,200 pounds of material are placed in the sealed vats and the bleach, dye liquors and wash waters are forced through the material by powerful pumps. If bleached before spinning, the cotton is dried, carded and twisted as described above.

The production of cotton yarn is the first step in the manufacture of a woven fabric. The weaving, while simple in theory, is exceedingly complicated in practice and can be mastered only by a vast amount of study. In cotton cloth, such as a piece of sheeting, the threads are in two groups, those running lengthwise forming the "warp" and the crosswise making the "woof" or filling. The threads

of the warp are unwound from a wooden cylinder or beam (23), as the filling is put in. In hand weaving, the filling thread is passed through from one side to the other, above the even numbered threads and below the odd numbered in one direction, and below the even and above the odd in the opposite direction. This is accomplished in the power loom by passing the warp threads, called drawing in, through wire eyes in two loom-harnesses—the odd threads through one harness and the even ones through a second. Drawing-in by hand is a laborious process. Care must be taken that each thread is passed through the proper eye of the harness. The operation is clearly shown in the film (25). When the warp tying machine is used (26), the end of the warp of a previous piece of cloth is allowed to remain in the harnesses which are removed to the tying machine where the corresponding threads of the old and new warps are tied together. The knots are then drawn through the eyes and cut off. The warp and its harnesses are next taken to the loom, the threads passed through the reeds of the lay and the harnesses hung. Suitable devices raise the first harness and depress the second, when the shuttle is sent flying between the sets of threads, unwinding the filling from the bobbin within it. Reeds between the warp threads then move forward, pressing the filling into place. A reversal of the positions of the harnesses precedes a return of the shuttle (27) (29).

In this "plain" weaving, different patterns may be secured by using threads of different colors in the warp and changing colors in the filling. Modern power looms are equipped with automatic shuttle changers (28) permitting the use of as many as six colors in the filling, the substitution of one color for another taking place as often as the pattern demands. Such designs as appear in ginghams are obtained in this manner.

A very large variety of fabrics is secured by introducing

different sizes of warp and filling threads, using a greater number of harnesses, drawing in the warp in different ways and varying the spacing of the filling. By various combinations many novel and attractive designs are produced. In practice the same loom is seldom used for more than one kind of fabric, yet it is interesting to note that sheerest muslin and a 10-ply conveyor-belt nearly a half-inch thick may be made on two looms which to the ordinary observer may appear to differ in but few points.

Among the latest improvements in loom appliances are the stop-motion devices, which automatically stop the machine when either a warp or filling thread breaks or gives out. It awakens a feeling of admiration for the inventor's ingenuity when, as one stands beside a massive loom with its shuttle flying back and forth, at a speed which the untrained eye cannot follow, the noise and clatter suddenly cease and the loom stops. Nothing appears to be wrong, but the operator instantly locates a thread, small, fine, apparently insignificant—but broken. Nor can the loom be started until this is repaired or replaced by a whole thread. Such a device makes it possible for one operator to tend as many as six looms.

Double-faced goods are in reality two separate fabrics, each requiring its own warp and filling, stitched together by an ingenious manipulation of the harnesses.

No phase of cotton weaving is more wonderful than the production of woven-in or figured patterns. Bed spreads, cotton-damask, and madras, are samples of this class of goods. In the loom weaving a figured pattern, each thread is controlled separately by a Jacquard movement, fitted on a frame several feet above the loom proper. This mechanism consists essentially of a series of from 200 to 1,200 vertical hooks, an equal number of horizontal needles, a set of lifting knives, and an endless chain of perforated cards. From the vertical hooks are cords extending down to the

wire eyes through which pass the warp threads. Ordinarily the knives engage the hooks and the threads are lifted at each pick, permitting the shuttle to pass beneath. However, when the perforated card is pressed against the horizontal needles, only those needles which do not enter perforations disengage their corresponding hooks. With the next lift of the knives, these hooks remain behind and the threads controlled by them are beneath the filler thread.

Hence with properly perforated cards any particular warp threads may be raised independently of all others, and many intricate and beautiful designs worked out which would require great skill in a loom operated by hand. When the pattern is duplicated several times in the width of the cloth the corresponding warp threads are controlled by the same hooks. The number of cards in the chain is determined by the number of filling threads before the pattern repeats. Very elaborate designs are sometimes produced such as a picture of the Landing of Columbus, a portrait of Abraham Lincoln and the Lord's Prayer. For these many thousand different cards are required.

The demand for cheap cloth with colored figures has opened a ready market for print cloths. The process is very similar to color work of newspaper printing. A series of rollers, each providing that portion of the design that is to be in a single color, are mounted around the circumference of a large padded drum. The cloth that is drawn between the drum and the rollers receives a portion of the design in the proper color from each roller. As many as sixteen colors may be applied by one machine. The process is very inexpensive and one machine may print from 12,000 to 15,000 yards of goods in a day.

Questions, Topics, Suggestions

1. In what parts of the world is cotton raised in large quantities?
2. State some interesting facts in the history of the use of cotton.
3. What is a cotton gin? Who invented it? When?
4. What uses are made of cotton seeds?
5. Trace the development of the inventions in the industry.
6. Secure a reference book on Textile Design and show pupils how some of the more common weaves are made.
7. Outline the influence of cotton on the Southern States.
8. What facts have favored the establishment of huge cotton manufacturing plants in New England?
9. Secure as many samples as possible; name them, and point out to pupils how design is secured.

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QUESTIONS ON THE FILM

1. Name in order the essential processes from the opening of the bale of cotton to the finished thread.
2. Explain each of the following processes: Opening, picking, scouring, dyeing, carding, drawing, roving, spinning.
3. Name in order the essential processes from thread to finished cloth.
4. Explain each of the following: Warp, filling, weaving, harness, lay, sliver.
5. Why are a number of shuttle-boxes seen on the gingham looms?
6. Describe the work of the harness of a loom.
7. What is the selvage and how is it formed?
8. Why is yarn "sized"?
9. Is the cotton for a gingham dyed as yarn or as cloth?
10. What is the length of the fold? Is this a legal measure?

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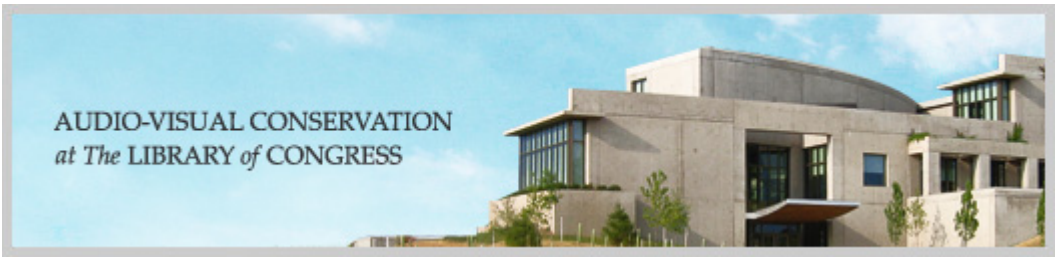

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